



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/813,176	03/31/2004	Masatomo Shibata	Q80822	4446

23373 7590 09/15/2006  
SUGHRUE MION, PLLC  
2100 PENNSYLVANIA AVENUE, N.W.  
SUITE 800  
WASHINGTON, DC 20037

EXAMINER

DOLAN, JENNIFER M

ART UNIT	PAPER NUMBER
----------	--------------

2813

DATE MAILED: 09/15/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/813,176

Applicant(s)

SHIBATA, MASATOMO

Examiner

Jennifer M. Dolan

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03 April 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) 3,5,9,12,14-16 and 25-45 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,6-8,10,11,13 and 17-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 August 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>3/31/04</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election without traverse of Group I and species I, including claims 1, 2, 4, 6-8, 10, 11, 13, and 17-24, in the reply filed on 4/3/06 is acknowledged. Claims 3, 5, 9, 12, 14-16, and 25-45 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

### ***Claim Objections***

2. Claims () are objected to because of the following informalities:

In claim 3, line 2, "re" should be replaced by --are--.

In claim 21, line 2, "an" should be replaced by --and--.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Art Unit: 2813

4. Claims 1, 2, 4, 6-8, 10, 11, 13, 22, and 23 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent Publication No. 2003/0134493 to Cho et al.

Regarding claims 1, 2, 4, and 6, Cho discloses a self-supported III-V nitride semiconductor substrate (paragraphs 0011, 0023 – GaN substrate or wafer) having a substantially uniform carrier concentration distribution throughout the wafer (paragraph 0025 – “extreme uniformity of doping”). Since the doping is considered to be uniform, the substrate inherently should not have high-brightness and low-brightness regions).

Regarding claims 7, 8, 10, 11, and 13, Cho discloses carrier concentrations both exceeding  $1 \times 10^{17} / \text{cm}^3$  and less than  $1 \times 10^{17} / \text{cm}^3$ . Since Cho specifically states that the concentration throughout the GaN substrate is extremely uniform (paragraph 0025), it is expected that the concentration variances would be very small, and hence, within the claimed ranges.

Regarding claims 22 and 23, Cho discloses that the substrate is GaN doped with an impurity (paragraphs 0023-0028).

5. Claims 1, 2, 4, 6-8, 10, 11, 13, and 17-24 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent Publication No. 2002/0046693 to Kiyoku et al.

Regarding claims 1, 2, 4, and 6, Kiyoku discloses a self-supported III-V nitride semiconductor substrate (17 or 116, see figures 5A-> 5B, paragraphs 0102-0103) having a substantially uniform carrier concentration distribution (see paragraph 0070) and thus no high or low brightness regions, throughout the self-supported layer (see paragraphs 0065, 0067, 0072, 0077, 0085, 0096-0099, noting that the method employed by Kiyoku is substantially similar to

Art Unit: 2813

the Applicant's 'Example 5' method, and thus should have similar resultant properties, and further noting that Kiyoku discloses that the upper layers 17 or 116 are made substantially defect free, and thus, should not exhibit variances in carrier uniformity resulting from pitting of the layer; also see Examples 2, 3, 5, 15, paragraphs 0145-0159, -230-0234). In the alternative, Kiyoku discloses forming the nitride substrate with no dopants, which then has a substantially uniform dopant concentration of 0.

Regarding claims 7, 8, 10, 11, and 13, Kiyoku discloses that the carrier concentration is in the range of  $5 \times 10^{16} - 5 \times 10^{21} / \text{cm}^3$  (see paragraph 0070). Since Kiyoku uses substantially similar methodology as the Applicant, and since Kiyoku shows that the pitting and defect density of the layer is very small (paragraphs 0072, 0077, Examples 2-5), it is inherently the case that the carrier concentration variation would be very small, and thus within the claimed ranges.

Regarding claims 17-18, Kiyoku discloses polishing the top and bottom surfaces (paragraph 0148, 0152, 0233).

Regarding claim 19, Kiyoku discloses that the thickness is preferably greater than 100 microns and less than 1 mm, which intersects with the claimed range (see paragraph 0068, 0103).

Regarding claim 20, Kiyoku discloses growth on a C-plane, which is a (0001) plane (see paragraph 0054).

Regarding claim 21, Kiyoku discloses a lower dislocation density on a top surface than on a bottom surface (see figures 5A-5B, 6A-6C; defects on the bottom surface terminate to form a smooth upper surface; also see paragraph 0308).

Regarding claims 22 and 23, Kiyoku discloses that the substrate is a doped GaN or AlGaN material (paragraphs 0035, 0070, 0077)

Regarding claim 24, Kiyoku discloses that the III-V crystal may be grown by HVPE (paragraph 0058).

6. Claims 1, 17-19, and 22-24 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,773,504 to Motoki et al.

Regarding claim 1, Motoki discloses a self-supported III-V nitride substrate (column 14, lines 45-50) having a substantially uniform carrier distribution on the outer surface (column 14, lines 8-10).

Regarding claim 17-18, Motoki teaches that the top and bottom surfaces of the substrate are polished (column 13, lines 60-66).

Regarding claim 19, Motoki teaches that the thickness of the substrate is 400 microns, which is within the claimed range (column 13, lines 65-67).

Regarding claims 22 and 23, Motoki teaches that the crystal is GaN doped with an impurity (see column 13, line 50 – column 14, line 30).

Regarding claim 24, Motoki discloses that the crystal is grown by HVPE (column 13, lines 48-67).

### ***Conclusion***

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- a. US 2003/0070607 to Koike et al. discloses a method wherein a GaN layer is degraded to form pits, and then another layer is grown upon the pitted layer, such that the

Art Unit: 2813

defects are not propagated to the second layer. It is expected that the doped GaN layer formed by this process would inherently have substantially uniform carrier concentration, and thus would read on the claimed invention.

b. EP 1 246 233 A2 to Usui et al. discloses formation of undoped GaN by the same methods disclosed by the Applicant, and thus reads on the claims assuming a uniform carrier concentration of zero.

c. U.S. Patent No. 6,447,604 to Flynn et al. discloses methods of forming freestanding GaN substrates.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2813

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jennifer M. Dolan  
Examiner  
Art Unit 2813

jmd

  
CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800